



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Landestopografie swisstopo

wissen wohin
savoir où
sapere dove
knowing where

swisstopo

Satellitendaten für Rapid Mapping

Données satellites pour le Rapid Mapping

Francesco Wyss





Inhalt / *Contenu*

1) Der NPOC

Le NPOC

2) Int. Charter & Copernicus EMS

Int. Charter & Copernicus EMS

3) Rapid Mapping mit Satellitenbildern:

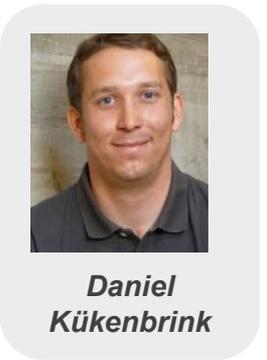
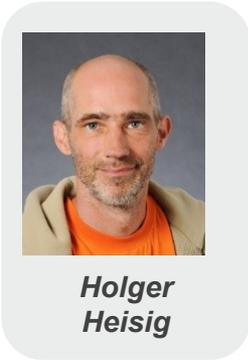
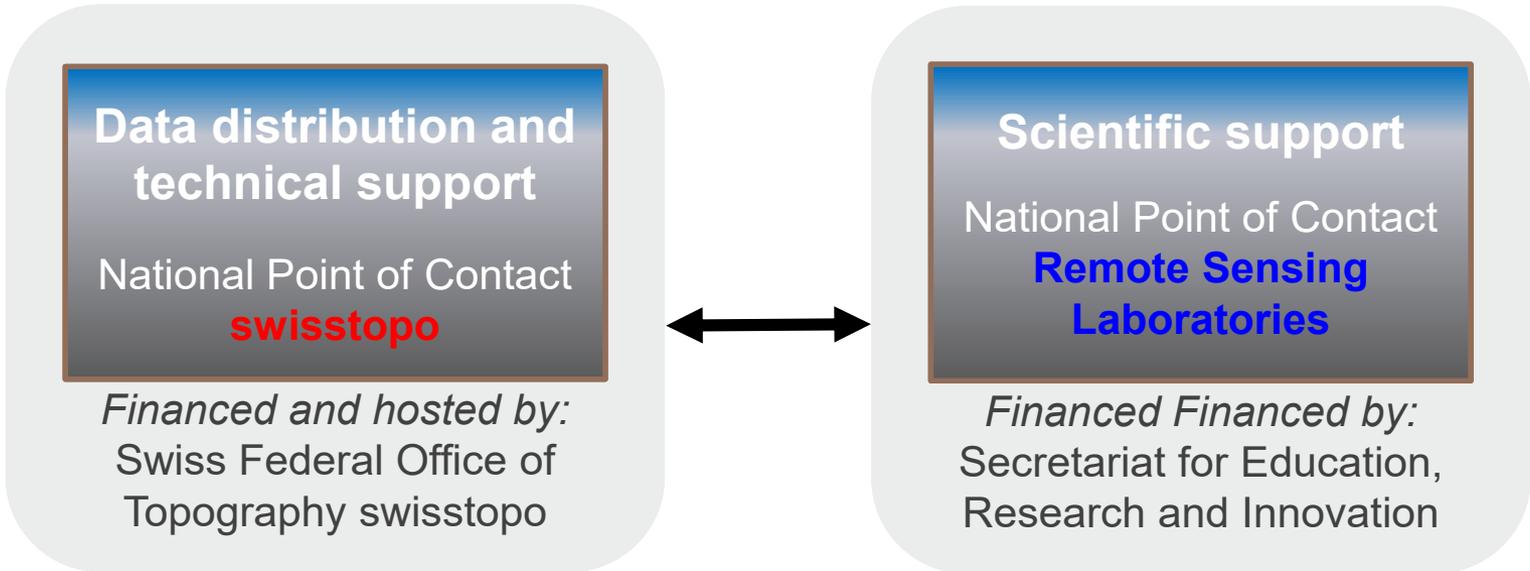
Übersicht, Vorteile, Nachteile

Rapid Mapping avec images satellites:

Vue d'ensemble, avantages et désavantages

4) Beispiel Rapid Mapping Einsatz

Exemple concret d'intervention Rapid Mapping





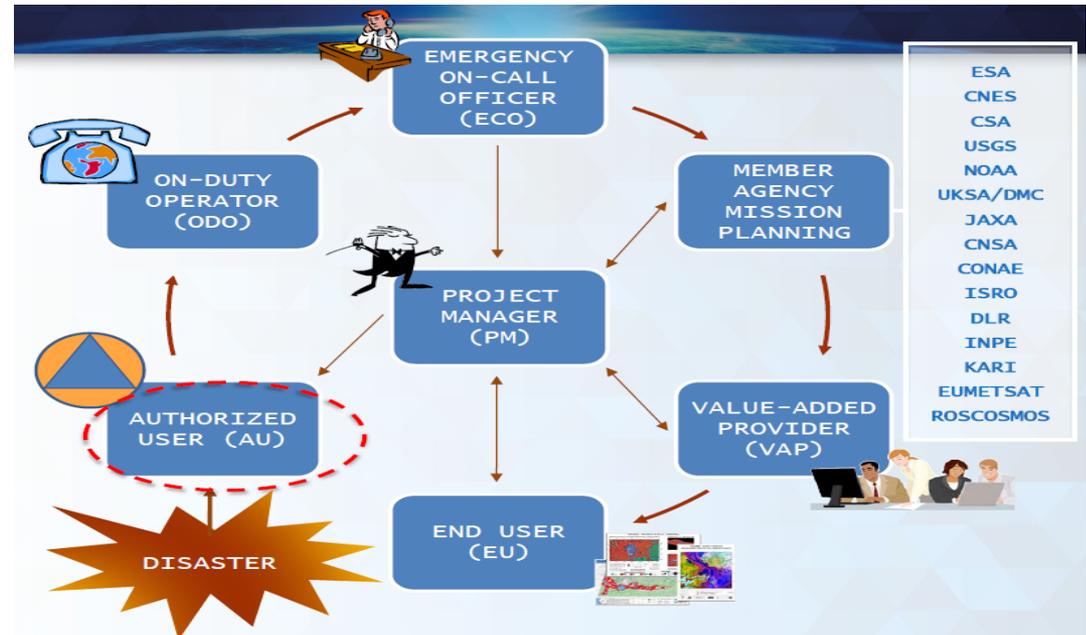
International Charter Space and Major Disasters

<https://disasterscharter.org>



Provides satellite data to those affected by natural or man-made disasters through registered organisations, for use in monitoring and response activities

- Voluntarily
- First priority
- Free of charge



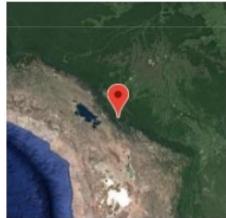
Die Schweiz ist Mitglied der Int. Charter / *La Suisse est membre de la Int. Charter*



International Charter Space and Major Disasters



Latest Charter Activations



08 FEBRUARY 2019

Landslide in Bolivia ▶



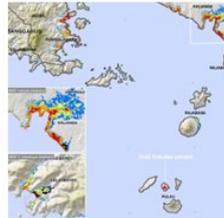
25 JANUARY 2019

Dam collapse in Brazil ▶



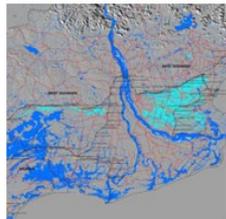
13 JANUARY 2019

Flood in Brazil ▶



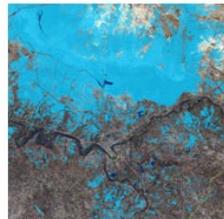
23 DECEMBER 2018

Tsunami in Indonesia ▶



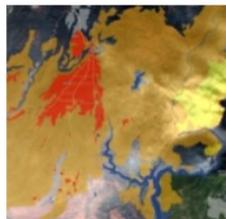
17 DECEMBER 2018

Cyclone Phethai in India ▶



25 NOVEMBER 2018

Flood in Iraq ▶



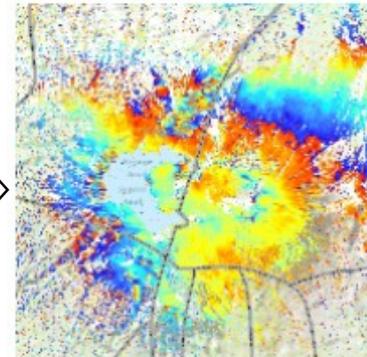
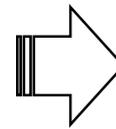
14 NOVEMBER 2018

Fires in California, The United States ▶



25 OCTOBER 2018

Flood in Russian Federation ▶



06 AUGUST 2018

Earthquake in Indonesia ▶

Type of Event:	Earthquake
Location of Event:	Indonesia
Date of Charter Activation:	2018-08-06
Time of Charter Activation:	14:06
Time zone of Charter Activation:	UTC+09:00
Charter Requestor:	ADRC on behalf of LAPAN, Indonesia
Activation ID:	580
Project Management:	AIT

International Charter Space and Major Disasters

Earthquake - Damage assessment Salangan area

Data Sources

Crisis layers

Settlements damage and emergency camps derived from

Pléiades image acquired the 07/08/2018

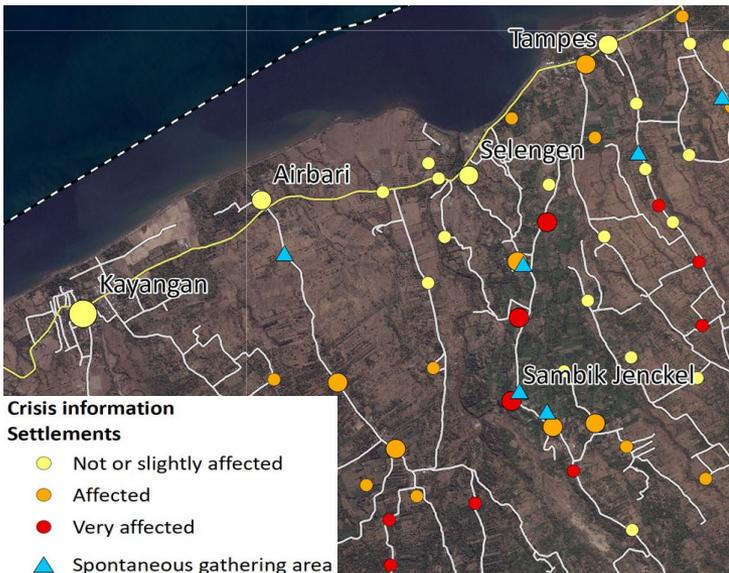
© SERTIT 2018

Background layers

Pléiades-HR 1A acquired the 07/08/2018

© CNES 2018, distribution Airbus Defense and Space

Sentinel-2A acquired the 06/08/2018 Copernicus Sentinel data



Bundesamt für Landestopografie swisstopo

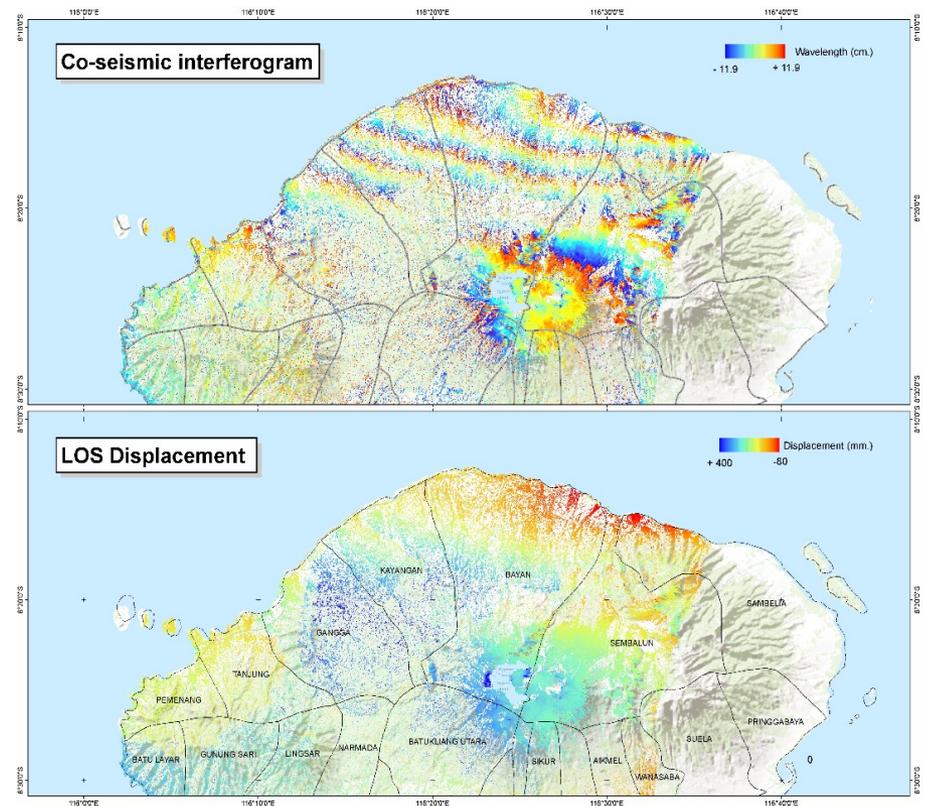
Data Sources

Satellite images:

Pre-earthquake: ALOS-2, 29 Dec 2015

Post-eruption : ALOS-2, 7 August 2018

Copyright : © JAXA (2018) - All rights reserved.



Kolloquium Rapid Mapping / Colloque Rapid Mapping, 8.3.2019



Copernicus - Emergency Management Service

<https://emergency.copernicus.eu>



Delivers warnings and risk assessments of floods & forest fires and provides **geospatial information derived from satellite images** on the impact of natural and man-made disasters all over the world



Rapid Mapping Products

Fast provision (**hours-days**) of geospatial information following a disaster.

Acquisition, processing and analysis of satellite imagery and other geospatial (raster/vector) data sources.

Reference, Delineation & Grading maps

Die Schweiz hat keinen Zugang zu EMS / *La Suisse n'a pas accès aux EMS*



Copernicus - Emergency Management Service



EMSR344: Forest fire in Corsica, France

Event Time (UTC): 2019-02-24 09:30
Event Time (LOC): 2019-02-24 10:30
Event Type: Wildfire (Forest fire)
Activation Time (UTC): 2019-02-24 10:11
Reference maps produced: 0 of 0
Delineation maps produced: 2 of 2
Grading maps produced: 1 of 1
Activation Status: Open
Affected Countries/Territories:
■ French Republic

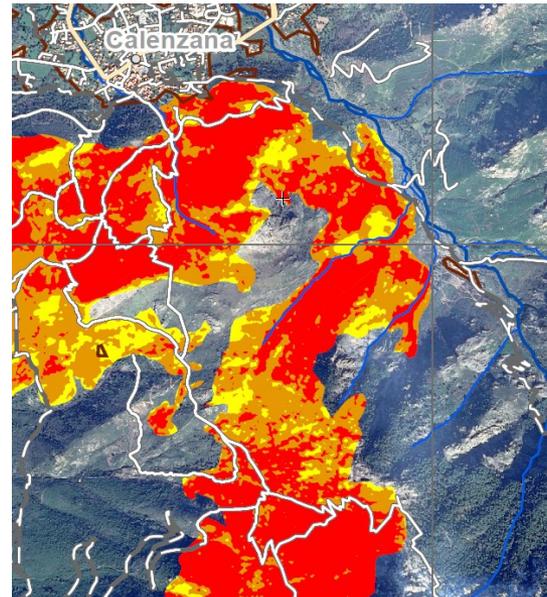
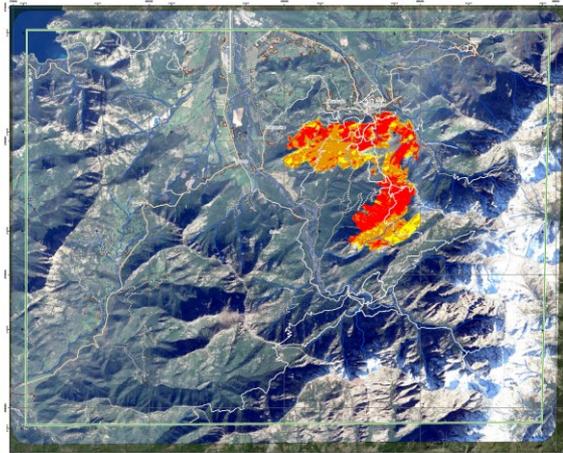
Data Sources

Pre-event image: SPOT6/7 © Airbus DS (2018), (acquired on 01/07/2018) at 09:50 UTC, GSD 1.5 m, approx. 0% cloud coverage in Aol, 25.7° off-nadir angle), provided under COPERNICUS by the European Union and ESA, all rights reserved.

Post-event image: SPOT6/7 © Airbus DS (2019), (acquired on 27/02/2019) at 09:59 UTC, GSD 1.5 m, approx. 6.8% cloud coverage in Aol, 17.2° off-nadir angle), provided under COPERNICUS by the European Union and ESA, all rights reserved.

Sentinel 2A/B (2019) (acquired on 26/02/2019) at 10:20 UTC, GSD 10 m, approx. 0% cloud coverage in Aol) provided under COPERNICUS by the European Union and ESA.

Grading (damage) Map



- Land Use-Cover Grading**
 - Destroyed
 - Damaged
 - Possibly damaged
- Built-Up Area**
 - Residential
 - Other non-residential
- Hydrography**
 - River
 - Stream
 - Lake
- General Information**
 - Area of Interest
- Administrative boundaries**
 - Region
 - Municipality
- Placenames**
 - Placename
- Transportation**
 - Secondary Road
 - Local Road
 - Cart Track
 - Airfield runway



Rapid Mapping mit Satellitenbilder

Rapid Mapping avec images satellites



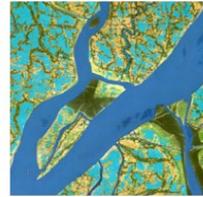
Cyclones ▶



Earthquakes ▶



Fires ▶

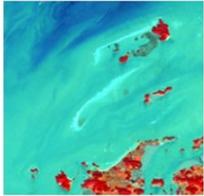


Floods ▶

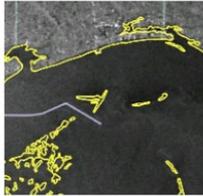


Snow and Ice ▶

Naturgefahren
Catastrophes naturelles



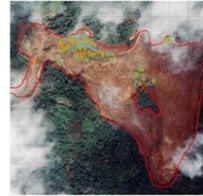
Ocean Waves ▶



Oil spills ▶



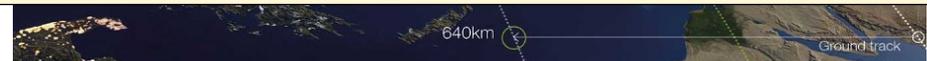
Volcanoes ▶



Landslides ▶



Auswahl vom Satellit abhängig von Katastrophentyp, gesuchten Objekten, Sensor-Auflösung (GSD/Kanäle), Satellit-Repetitionsrate, Streifenbreite, Interessengebiet
Choix du satellite dépendant du type de catastrophe, objets recherchés, résolution du capteur (GSD/canaux), taux de répétition du satellite, largeur de la bande de scannage, zone d'intérêt

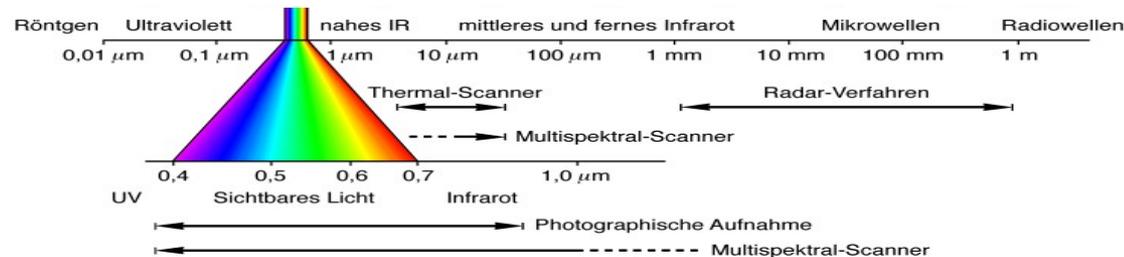




Rapid Mapping mit Satellitenbilder

Rapid Mapping avec images satellites

Szenario «Überschwemmung» / *Scénario «Inondation»*



Optische Daten (inklusive mittlerer Infrarot) → in **wolkenfreien Situationen**.

Sensoren mit mittlerer Auflösung für großflächige Ereignisse, mit hochauflösenden Aufnahmen in betroffenen Gebieten mit hoher Priorität.

Données optiques (y compris moyen infrarouge) → dans les situations sans nuages. Capteurs de moyenne résolution pour les grands événements, avec des collections à haute résolution dans les zones d'impact des cibles prioritaires.

Radar-Daten → aufgrund ihrer **Allwettertauglichkeit** geeignet für die Hochwasserüberwachung und die Kartierung der Überschwemmungsflächen.

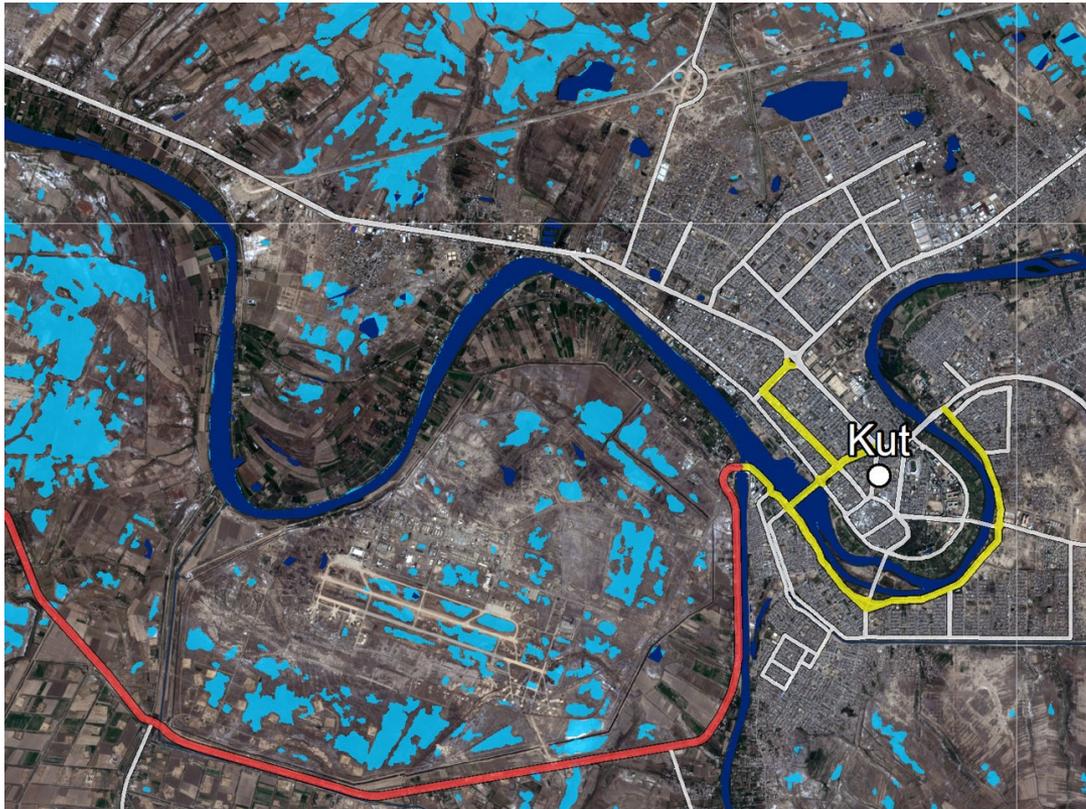
Données radar → Grâce à leur indépendance aux conditions météo, ces données sont adaptées pour la surveillance des crues et la cartographie des zones inondées



Rapid Mapping mit Satellitenbilder

Rapid Mapping avec images satellites

Szenario «Überschwemmung» / *Scénario «Inondation»*



Data Sources

Crisis layer
Flooded area derived from Sentinel-1 image acquired the 26/11/2018
© SERTIT 2018

Reference layers
Water bodies derived from Sentinel-2 image acquired the 31/10/2018
© SERTIT 2018
Roads
© OpenStreetMap contributors 2018

Background layer
Sentinel-2 image acquired the 31/10/2018
© European Space Agency - ESA 2018

Legend

Crisis Information

 Flooded area
(26/11/2018 02:54 UTC)

Hydrology

 Reference water body

RADAR
OPTICAL

Infrastructures

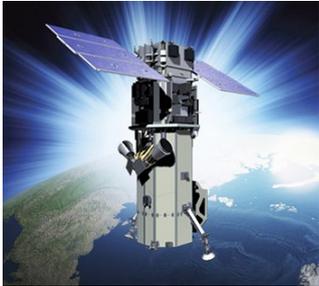
 Primary road
 Secondary road
 Tertiary road



Satelliten & Sensoren / *Satellites & capteurs*

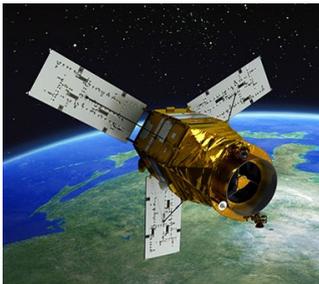
Optische / *Optique*

Very High Resolution (<1m GSD)



WorldView-3/-4

- DigitalGlobe (USA)
- Launched in 2014/2016
- Sensors WV3 PAN/MS
- 13.1km swath
- 0.31m PAN/1.24m MS GSD



Komsat-3A

- KARI (KOR)
- Launched in 2015
- Sensor AEISS-A
- 12km swath
- 0.55m PAN/2.2m MS GSD



Pleiades-1A/-1B

- AIRBUS (FRA)
- Launched in 2011/2012
- Sensor HiRI
- 20km swath
- 0.7m PAN/2.8m MS GSD

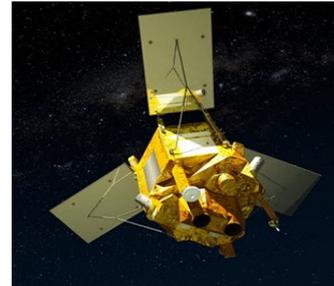
Optische / *Optique*

High Resolution (1-5m GSD)



DMC-3

- 21AT (CHN)
- Launched in 2015
- Sensor VHRI-100
- 23 km swath
- 1m PAN/4m MS GSD



Spot-6/-7

- AIRBUS (FRA)
- Launched in 2012/2014
- Sensor NAOMI
- 60km swath
- 1.5m PAN/6m MS GSD



RapidEye 1-5

- Planet (USA)
- Launched in 2008
- Sensor REIS
- 77km swath
- 5m MS GSD



Satelliten & Sensoren / *Satellites & capteurs*

Optische / *Optique*

Medium Resolution (**10-15m GSD**)



Sentinel-2A/-2B

- ESA (EU)
- Launched in 2015/2016
- Sensor MSI
- 290km swath
- 10m GSD



Landsat-8

- USGS (USA)
- Launched in 2013
- Sensor OLI
- 195km swath
- 15m PAN / 30m MS GSD



Terra

- NASA (USA)
- Launched in 1999
- Sensor ASTER
- 60km swath
- 15m MS GSD

Mikrowellen / *Micro-ondes*

RADAR (**25cm-5m GSD**)



TerraSAR-X/TanDEM-X/PAZ

- AIRBUS (Frau)
- Launched in 2007/2017/2018
- X-Band
- 10x10km swath
- 25cm GSD (HRSM)



COSMO-SkyMed 1-4

- ASI (ITA)
- Launched in 2007-2010
- X-Band
- 10x10km swath
- <1m GSD (SL)



Sentinel-1A/-1B

- ESA (EU)
- Launched in 2014/2015
- C-Band
- 80km swath
- 5m GSD (SM)



Rapid Mapping mit Satellitenbilder

Rapid Mapping avec images satellites

Vorteile / *Avantages*

- + Verfügbarkeit von Satelliten
Disponibilité des satellites
- + Wiederholungsrate
Répétitivité des observations
- + Aufnahmefläche
Surface d'enregistrement
- + Satellit immer operationell
Satellite toujours opérationnel
- + Keine Flugsicherheitsbeschränkungen
Pas de restrictions du trafic aérien

Nachteile / *Désavantages*

- Wolken
Nuages
- Aufnahmewinkel bis zu 45°
Angle d'enregistrement jusqu'à 45°
- Bildauflösung
Résolution de l'image
- Zuverlässigkeit der Erfassung
Fiabilité de l'acquisition
- Besitzrechte der Daten
Droits de propriété des images



Beispiel Lawinen 2019 / *Exemple Avalanches 2019*

Anfang Januar 2019: Grosse Schneefälle über Zentralschweiz

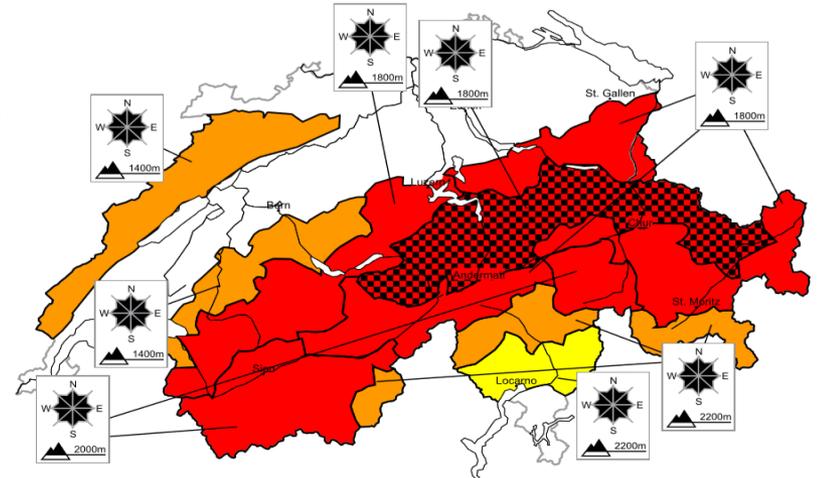
Début janvier 2019: Fortes chutes de neige sur la Suisse centrale

14.01.2019:

Lawinengefahr Stufe 5 über weite Teile der Schweiz

Niveau de danger d'avalanche 5 sur une grande partie de la Suisse

Lawinenbulletin WSL-Institut / *Bulletin d'avalanche WSL-Institut*



Gefahrenstufen	■ 1 gering	■ 2 mässig	■ 3 erheblich	■ 4 gross	■ 5 sehr gross
Degrés de danger	■ 1 faible	■ 2 limité	■ 3 marqué	■ 4 fort	■ 5 très fort

15.01.2019:

Anfrage vom BAFU an SPOC Rapid Mapping

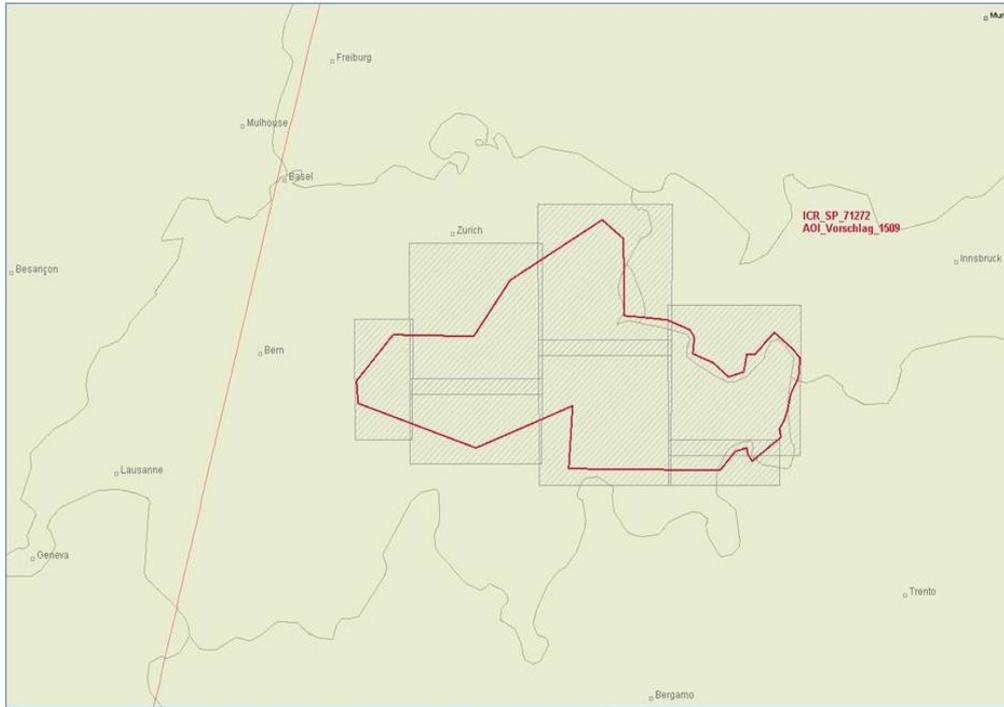
→ Post-Disaster Orthophoto (1.5m) aus Satellitenbildern

Demande de l'OFEV au SPOC Rapid Mapping

→ Post-Disaster Orthophoto (1.5m) issue d'images satellites



Beispiel Lawinen 2019 / *Exemple Avalanches 2019*



Emergency Priority Tasking

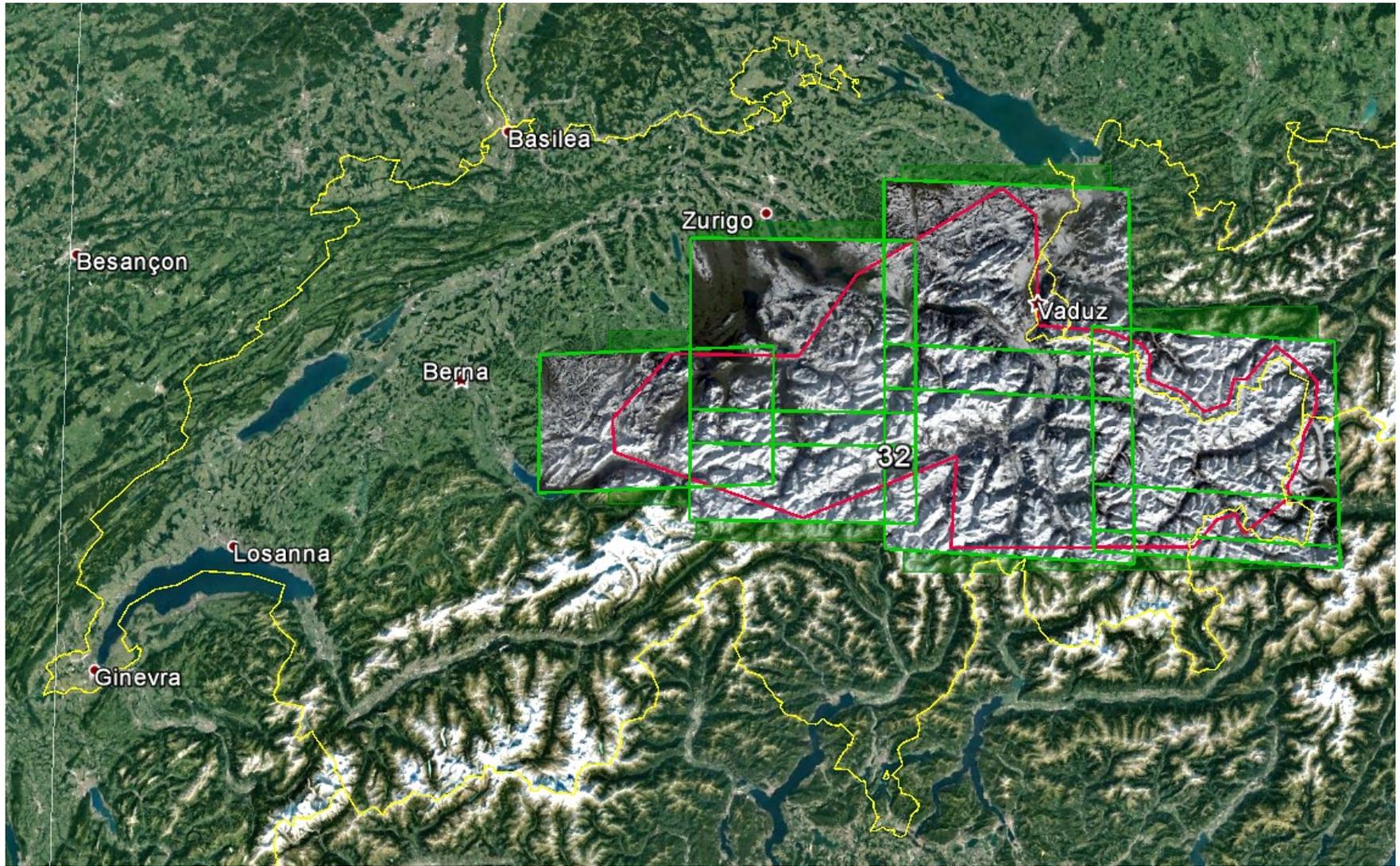
- Tasking OneDay
- Spot 6/7
- AOI 9877 km²
- **16.01.2019**
- Pansharpened 1.5m 4-bands
- 16 bits
- Primary
- GeoTIFF
- Primary

Customer reference	Viewing attempt ID	Mean acquisition date	Satellite	Orbit
AOI_Vorschlag_1509	VA_SP_71272_1_1_1	16/01/2019 10:05:51.493 (UTC)	SPO76	249
AOI_Vorschlag_1509	VA_SP_71272_1_2_1	16/01/2019 10:05:44.806 (UTC)	SPO76	249
AOI_Vorschlag_1509	VA_SP_71272_1_3_1	16/01/2019 10:05:52.181 (UTC)	SPO76	249
AOI_Vorschlag_1509	VA_SP_71272_1_4_1	16/01/2019 10:05:39.993 (UTC)	SPO76	249
AOI_Vorschlag_1509	VA_SP_71272_1_5_1	16/01/2019 10:05:47.368 (UTC)	SPO76	249
AOI_Vorschlag_1509	VA_SP_71272_1_6_1	16/01/2019 10:05:43.056 (UTC)	SPO76	249
AOI_Vorschlag_1509	VA_SP_71272_1_7_1	16/01/2019 10:05:50.493 (UTC)	SPO76	249

1 Orbitaldurchgang, 7 Aufnahmen (in 10 Sekunden)
1 passage orbital, 7 images (en 10 secondes)



Beispiel Lawinen 2019 / *Exemple Avalanches 2019*





Beispiel Lawinen 2019 / *Exemple Avalanches 2019*

Zeitleiste Ereignis / *Chronologie de l'événement*

TRIGGER – TASK – PROCESS – DELIVER – PUBLISH



- DAY 1 (15.1.19) 12:18h** Bildbestellung durch BAFU
Demande d'images par l'OFEV
- 12:18h** Tasking der Satellitenbilder durch NPOC
Tasking des images par le NPOC
- DAY 2 (16.1.19) 15:15h** Airbus Notification: Spot- Daten verfügbar
Airbus Notification: Données Spot disponibles
- 15:54h** Primary Daten heruntergeladen und auf Bundes-
netzwerk transferiert
*Données Primary téléchargées & transférées sur
le réseau de fédéral (à disposition de l'OFEV)*



Beispiel Lawinen 2019 / *Exemple Avalanches 2019*

Zeitleiste Ereignis / *Chronologie de l'événement*

TRIGGER – TASK – PROCESS – DELIVER – PUBLISH

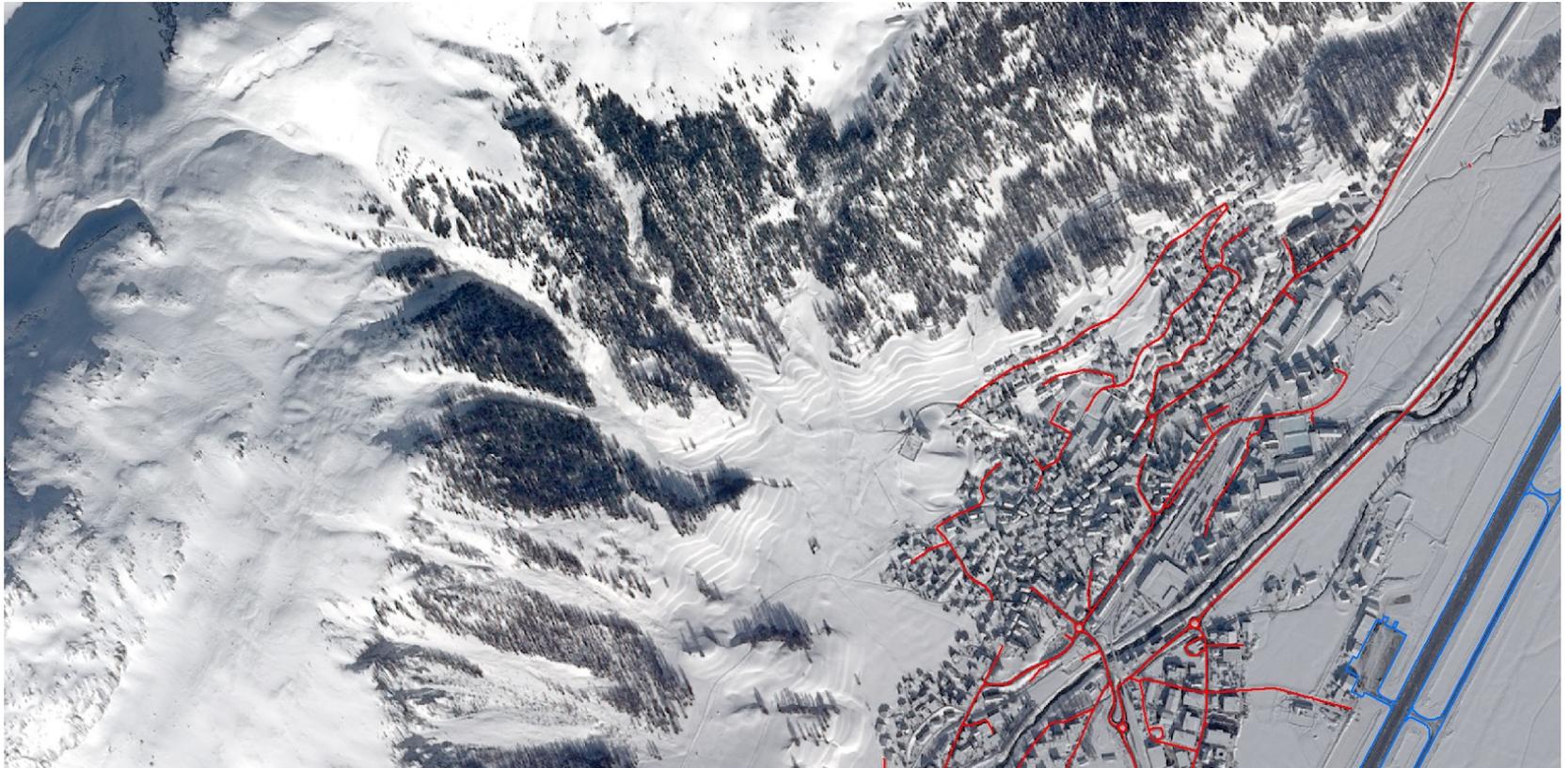


- DAY 3 (17.1.19) 17:25h** Datenverarbeitung & -lieferung abgeschlossen (Orthorektifizierung, Kachelung, Komprimierung), 16 Bit Orthofotos beim BAFU verfügbar
Traitement et livraison des données terminés (orthorectification, découpage, compression), orthophotos 16 bit disponibles chez l'OFEV
- DAY 4 (18.1.19) 09:26h** 8 Bit Daten auf map.geo.admin.ch publiziert
Données 8 bit publiées sur map.geo.admin.ch
- DAY 5 (19.1.19) 01:10h** 16 Bit Daten per switch drive ans SLF überliefert
Données 16 bit transférées par switch drive au SLF



Beispiel Lawinen 2019 / *Exemple Avalanches 2019*

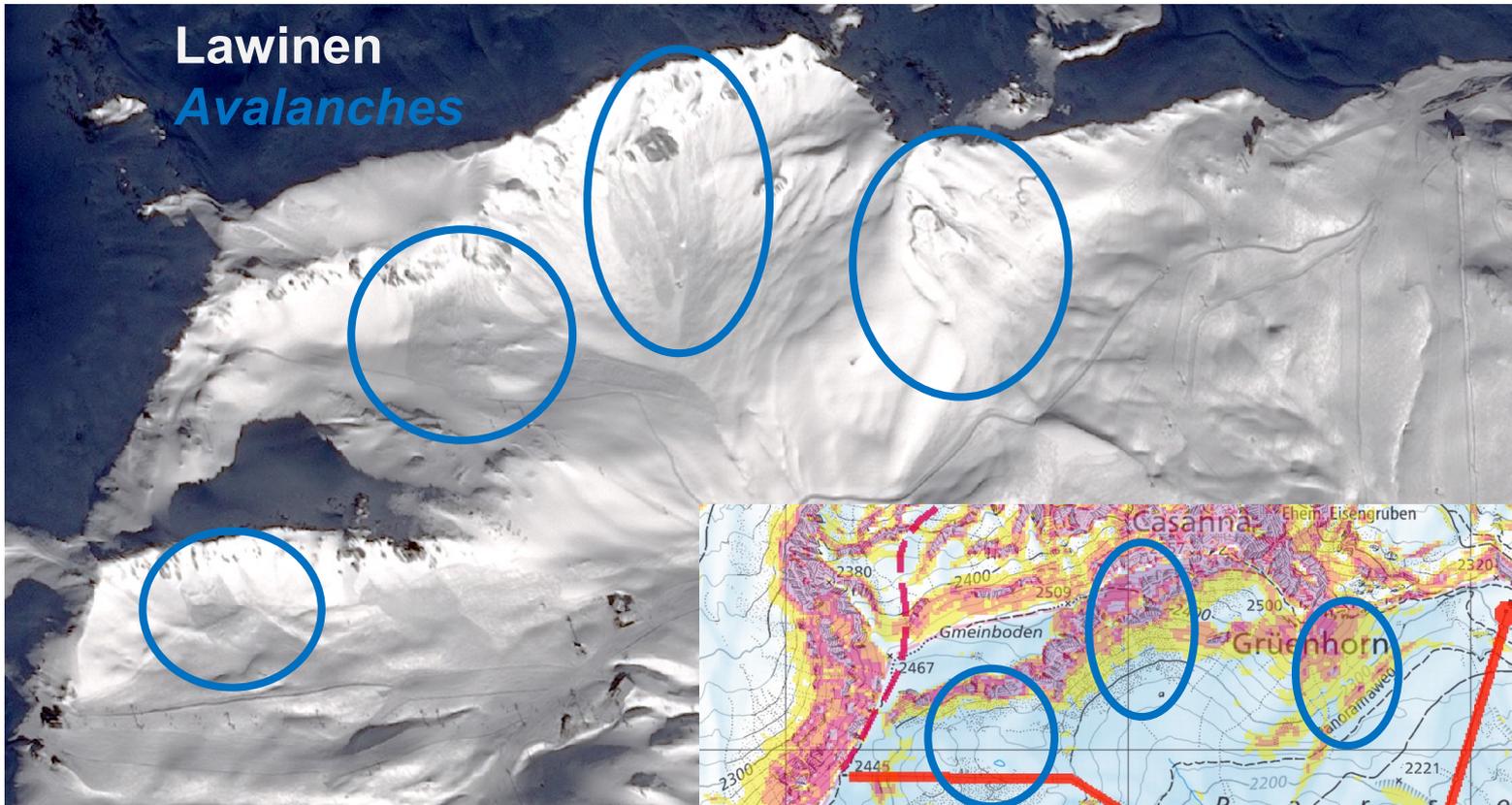
Orthorektifizierung der Satellitenbilder / *Orthorectification des images satellites*



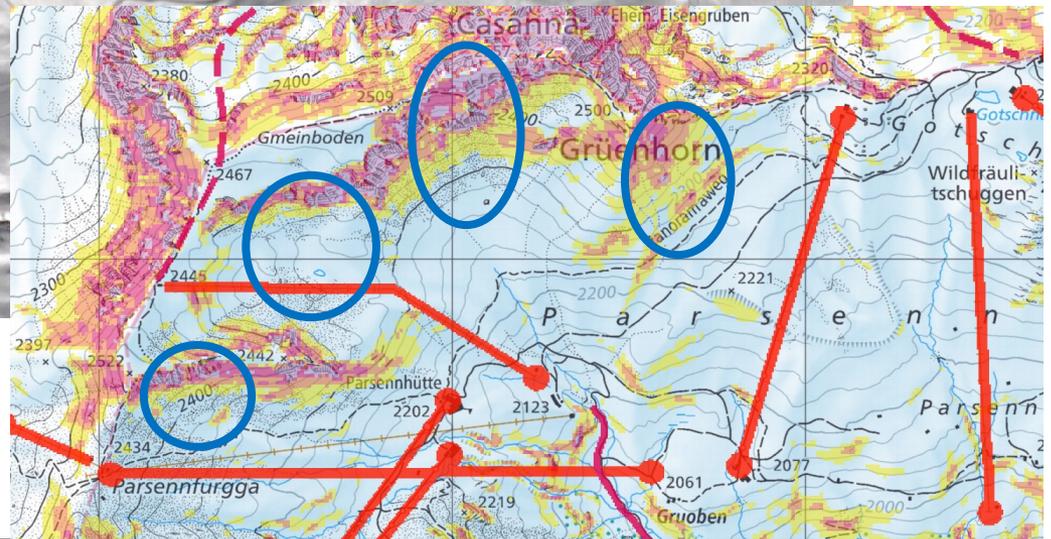
Samedan



Beispiel Lawinen 2019 / *Exemple Avalanches 2019*



Skigebiet Parsenn (Davos)
Domaine skiable Parsenn (Davos)





Beispiel Lawinen 2019 / *Exemple Avalanches 2019*



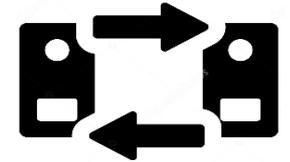
Kommunikation/Koordination BAFU – swisstopo – SLF
Communication/Coordination OFEV – swisstopo – SLF



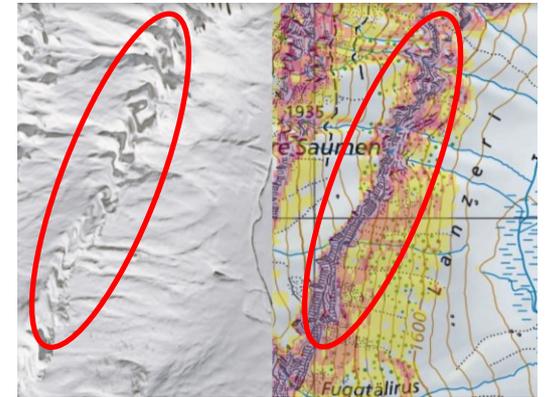
Zeitspanne zwischen Datenaufnahme & Publikation map.geo.admin
Délai entre acquisition des données & publication map.geo.admin



Übertragung grosser Datenmengen ausserhalb Bundesnetz
*Transmission de grandes quantités de données
à l'extérieur du réseau fédéral*



Geometrische Verzerrungen (pixel stretching)
Distorsions géométriques (pixel stretching)





Fazit / *Conclusions*



- Satellitendaten bei Katastrophenhilfe nützlich (Ereignisspezifisch!)
Images satellites utiles dans l'aide aux catastrophes (spécifiques au type d'événement!)



- Ausgebildete Rapid Mapping Team von mehrere Personen (Pikett/Fachkräfte)
Équipe Rapid Mapping composée de plusieurs personnes formées (Piquet /Experts)



- Produktdefinition in Absprache mit dem Nutzer
Quick Orthofoto → Ereignisbewältigung
Orthofoto → Ereignisdokumentation
Définition des produits en accord avec les utilisateurs
Quick Orthophoto → Maîtrise de l'événement
Orthophoto → Documentation de l'événement



Danke für eure Aufmerksamkeit!
Merci de votre attention!



<http://www.npoc.ch>
NPOC@swisstopo.ch
NPOC@geo.uzh.ch